Appendix F

Analysis of Alternative 10 to Minimize Adverse Impacts to Essential Fish Habitat: Buyout and Establishment of No-Trawl Zones off the Central California Coast

The Nature Conservancy of California
and
Environmental Defense

Chuck Cook and Mary Gleason (The Nature Conservancy)
Rod Fujita (Environmental Defense)

December 10, 2004

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PROJECT DESCRIPTION

In July 2003, The Nature Conservancy [TNC] of California and Environmental Defense initiated exploratory discussions with participants in the bottom trawling industry (fishermen and processors) along the Central Coast of California. TNC, Environmental Defense, and many of the participants began to explore and understand how, together, we might protect benthic habitat for groundfish and move towards more sustainable fisheries, including bottom trawling, in marine waters extending from Point Conception to Davenport, California (Figure 1).

The project aims to protect biodiversity and promote recovery of groundfish stocks through the establishment of large no-trawl zones in waters between Point Conception and Davenport. The concept that emerged is for private funders to purchase a significant majority of the bottom trawlers in the project area contingent upon a commitment from NOAA Fisheries and the Pacific Fishery Management Council to establish substantial no-trawl zones to protect high-value conservation areas within the project area. Participatory research would be conducted to take advantage of the no-trawl zones to investigate the recovery of ecosystem structure and function, including groundfish populations. While our mission is the protection and conservation of biodiversity, we strive to employ innovative strategies that engage stakeholders and minimize conflicts with resource users. Our project would significantly reduce the adverse economic impacts that would normally be associated with the establishment of large no-trawl areas by purchasing a substantial majority of the trawlers and permits fishing the project area. We forecast purchasing 13-15 of the 23 permits/vessels involved in our project area.

<u>Project Area Description</u>

The Central Coast project area extends from Point Conception to Davenport, California and includes the offshore seamounts (Gumdrop, Guide, Pioneer, Davidson, and Rodriguez). This area was selected because of its incredible biological diversity and ecological value. The presence of large canyons near shore creates high bathymetric complexity and habitat complexity. It contains nearly the full range of habitat types found on the continental shelf and slope, including estuaries, nearshore rocky reefs, kelp forests, highly diverse soft and mixed bottom habitats, deep canyons and near-shore canyon heads, offshore banks, upwellings and seamounts.. These diverse habitat types are critical for the support of a correspondingly rich array of species, including 21 cetacean species, 6 pinniped species, 184 species of shore and sea birds, and hundreds of fish and invertebrate species. In addition, there is evidence suggesting that benthic biodiversity peaks in upwelling zones at the shelf/slope break in 200 – 300 m of water in this area.

The project boundaries from Point Conception to Davenport and down to 3000 meters, were chosen for two reasons:

- First, the Monterey Bay National Marine Sanctuary and areas south to Point Conception are ecologically and biologically important and unique. The area supports multiple and viable examples of important ecosystems, communities, species and essential fish habitat across environmental gradients. Many of these areas are considered important for growth, reproduction or survival of many species due to their role as nursery grounds, critical habitats or topographical features around which mobile animals aggregate. Nowhere else along the Pacific west coast supports the abundance and diversity of near-shore canyons, ledges and canyon heads.
- Secondly, the area is a good representation of the historical fishing grounds for bottom trawlers who port in Avila, Morro Bay, Monterey, Moss Landing and Half Moon Bay. While the project boundary does not represent their entire fishing area, it is likely to cover the great majority of it.

The northern project boundary may change slightly as negotiations proceed, because we do not yet know which trawlers will sell and which will remain. Moreover, the continental shelf in the current project area is quite narrow in general, constraining the scope for negotiating trawlable areas. The area north of Davenport (to Pillar Point) contains additional high-value rocky habitat, the Pioneer canyon complex, the Ano Nuevo upwelling area and a relatively broad shelf which would increase opportunities to leave trawlable areas open.

NEED FOR ACTION

The National Academy of Sciences has stated that "…there is an extensive literature on the effects of fishing on the seafloor. It is both possible and necessary to use this existing information to more effectively manage the effects of fishing on habitat" (NRC 2002). They recommend that management of the effects of trawling should be accomplished by a combination of:

- Fishing effort reductions
- Modification of gear design or gear type
- Establishment of closed areas to fishing

Bottom-trawling has become a source of concern because of the size of the affected fishing grounds, the modification of the substrate, disturbance of benthic communities and removal of non-target species (NRC 2002).

The draft risk analysis for Pacific groundfish included an evaluation of the sensitivity of different habitat types to fishing impacts from 5 major gear types, including bottom trawling, and ranked portions of the project area, especially rocky portions of the shelf and slope, with the highest sensitivity ranking (2.26-3.0) and longest recovery times (Risk Assessment for the Pacific Groundfish FMP, v. 4. August 2004).

Few studies of the impacts of trawling have been conducted in the project area; however, the scientific consensus (including the expert opinion of scientists serving on the Pacific Fishery Management Council's technical advisory committee on Essential Fish Habitat, which is charged in part with assessing the impacts of fishing in federal waters off the US Pacific coast) is that inferences about the impacts of trawling in a particular place can be made from the dozens of studies of trawl impacts conducted throughout the world, with appropriate adjustments made for differences in habitat type, biota, and fishing practices. More background information is provided in Appendix 1 to this document.

PROJECT IMPLEMENTATION

Despite some differences of opinion concerning the validity of scientific issues that have guided or misguided past management protocols, trawl fishermen, processors, TNC, and Environmental Defense have moved forward in our discussions concerning a private sector purchase of numerous federal bottom trawling permits and vessels.

TNC and Environmental Defense have a working list of fishermen who we think regularly trawl the project area (23 permit holders) and we have met with all of those owners or their representatives. Most of the fishermen home port in Morro Bay, Moss Landing, Monterey or Half Moon Bay. We are also meeting with local processors and open-access fishery representatives to gauge potential impacts on these sectors and develop solutions to address their concerns. Our project approach would be to purchase a significant majority of the bottom trawling permits and vessels and perhaps processors in this region in exchange for a significant portion of the project area designated as no-bottom-trawl zones. The no-trawl zones would be sited using a participatory process with the goal of maximizing conservation gains while minimizing adverse socioeconomic impacts on processors and fishermen and their workforces. We intend to work closely with the residual fleet members to identify key fishing grounds that would remain open for bottom trawling.

It is important to note that while this project could potentially result in the establishment of large no-trawl zones, it is being considered only as a mitigation alternative. The project is site-specific and will not apply to the entire area of PFMC's jurisdiction and so should not be construed as a full EFH designation alternative. Rather, it is intended to complement a broader-scale EFH alternative with a geographic scope that is consonant with the PFMC's jurisdiction.

The following project components are being explored and discussed amongst the parties. This summary does not imply that any agreements have been reached or decisions have been made by any of the parties.

Protection of Essential Fish Habitat, Conservation of Biodiversity, and Scientific Research Objectives for the Project

The project aims to protect biodiversity and promote recovery of groundfish stocks through the establishment of large no-trawl zones in federal waters between Point Conception and Davenport. The no-trawl zones would include representative benthic habitats (hard, soft, and mixed substrates in several depth ranges), biogenic systems, as well as important benthic features such as submarine canyons, sea-mounts, the shelf-slope break, and offshore reefs and banks that are important components of EFH for multiple species of groundfish and their various life stages. These no-trawl zones should comprise a significant but yet-to-be-determined percentage of the project's geographical area. This proposal aims to protect representative seafloor habitats at sites currently not impacted by bottom trawling and to allow previously trawled areas to recover.

Another important project objective is to be able to scientifically evaluate the ecosystem recovery process, if any, by monitoring, observing and documenting what happens to the benthic habitats, and the biodiversity they support, post-trawling. In discussions amongst industry participants and conservation groups, it is clear that both camps distrust the "science" of the other side and this sticking point has been a major impediment to moving forward on an acceptable management plan for groundfish. This proposal, if successful, will provide a unique "living laboratory" for scientific research opportunities aimed at objectively determining the impacts, if any, on dragging the seafloor in the Central Coast of California.

Through careful siting and monitoring of replicated no–trawl zones, the scientific community and industry can address critical questions that need to be answered to guide adaptive management of marine resources. There is an abundance of baseline information and data on current condition of the shelf, slope, and canyon habitats from numerous research projects conducted by the many marine research institutions in the central coast (NMFS Santa Cruz Laboratory, University of California Santa Cruz, Moss Landing Marine Laboratory, Monterey Bay Aquarium Research Institute, and others). This existing information will be used to develop specific hypotheses which would drive the selection of monitoring parameters and monitoring areas. Monitoring (via ROV and bottom sampling) could be augmented by manipulative experiments to isolate the effects of variables such as other types of fishing. Models incorporating environmental variables (e.g., temperature, nutrient availability), ecological variables and socioeconomic variables (e.g., fishing effort) would be developed to integrate information gathered and develop new hypotheses. We suggest that research efforts that examine the impacts of bottom trawling in the Central Coast be jointly funded by the trawl industry, conservation community and NOAA.

<u>The Nature Conservancy and Environmental Defense have Attempted to Identify the Fishermen's Objectives for the Project</u>

While we clearly do not pretend to represent Central Coast trawlers, we have been informed about many of the fishermen's concerns with our proposal. The most frequently heard concerns include:

1. Fishermen who wish to remain in the industry are concerned that their “rights” to trawl in their fishing grounds through the establishment of designated bottom trawl zones between Point Conception and Davenport are protected. These areas should comprise a yet to be determined percentage of the project area and be located in areas that can sustain their businesses financially.

2. Fishermen want to eliminate current and future contradictions and confusion between the Rockfish Closure Areas, potential Essential Fish Habitat designations, potential marine reserves and potential no-trawl zones. In other words, they wish to simplify the rules for bottom trawlers and remove some of the uncertainty going forward.

3. Fishermen want an equitable formula for valuing the permits and vessels that can be agreed upon by buyer and sellers.

4. Fishermen want flexibility in the private acquisition process by giving consideration for allowing fishers to retain their vessels for future participation in NON-bottom trawl related fisheries, especially where they already own permits for different fisheries.

5. Fishermen want readily available landings, processors, and markets to sell their fish. Consequently, we have initiated discussions with companies that land, buy, transport and process groundfish in the project area. In order to try and project the impacts of our project on this group of businesses, we have talked with Old Port Seafood in Avila Beach, Del Mar in Watsonville and Moss Landing, Bay Fresh in Moss Landing, Monterey Seafoods, Royale Seafood in Monterey, Three Captains in Half Moon Bay and Solomon Live Fish in Moss Landing. We have also initiated discussions with the Alliance of Sustainable Fishers and the harbor masters in Avila, Morro, Monterey and Moss Landing. Part of these discussions evolve around how current activities accomplished by existing businesses may shift, consolidate or change due to the implementation of our project. Several of the fish buyers and processors in the project area also own "A" endorsement trawl permits and vessels, and should they decide to sell their permits and vessels, they may also elect to sell their seafood companies as well. Should that happen, we believe that companies like Bay Fresh, Royale, and Monterey Fish would stand to "inherit" the business given up by those companies that decide to sell. The largest impact may be in processing local fish; we project that some species of

groundfish would be landed and bought locally and then transported to the Bay Area for processing.

6. Bearing in mind that the buyout that we are proposing would, in and of itself, greatly reduce economic impacts arising from no-trawl zones in the project area, both TNC and Environmental Defense are committed to soften the impact of shifts and consolidations in the industry that may result from the implementation of our project. We will encourage companies and fisherman who may be the beneficiaries of the private buyback to give due financial consideration to employees who may be terminated; and likewise, we will do the same and consider some type of severance and/or training programs to assist in their transition to another job or career. Vessel crews, processing employees, skippers and other industry employees will be considered for assistance.

Mechanism of Transactions and Potential Council Actions; Projected Timelines

There are many project components that need to be executed between the fishers and TNC/Environmental Defense, as well as by the Council and NMFS, for this private buyout endeavor to be successful. Many of these actions are explicitly linked and will require extraordinary coordination and cooperation amongst the private and government parties. Our current thinking includes the following recommended sequence of actions:

Recommended Actions	Timeline
1. PFMC chose The Nature Conservancy/Environmental Defense proposal as a preferred mitigation alternative (Alternative 10) to be analyzed in the EFH –EIS; NOAA assists with detailed socioeconomic and ecological analysis.	November, 2004
2. TNC and Environmental Defense work with NOAA on the analysis of Alternative 10	December, 2004 – January, 2005
3. The Council and NMFS work with TNC/Environmental Defense and the fishermen to designate a geographical project boundary for our alternative	December 2004
4. TNC/Environmental Defense and industry participants continue discussions and negotiations on key issues of valuation and attempt to reach agreement.	Dec., 2004 - February 2005
5. TNC/Environmental Defense and industry participants identify and negotiate trawl and no- trawl zones and make a joint recommendation to NMFS and the Council	Dec., 2004 - February 2005
6. The Council approves the trawl and no-trawl zones contingent upon TNC/Environmental Defense successfully negotiating an option to purchase or contract to purchase at least 50% of the eligible permits in the project area and TNC/Environmental Defense having a proven line of credit available to close those transactions. The contracts would be required to be consummated before or soon after the no-trawl zones went into effect.	To be determined

Identification of Proposed No-Trawl Zones and Designated Trawl Zones

TNC and Environmental Defense will work with the trawlers and the agencies to jointly identify no-trawl zones based on TNC's assessment of areas of high conservation value, the fishermen's first hand knowledge of the area, and the best available information from relevant agencies and informed scientists. With the local knowledge from fishers, we hope to improve on our benthic habitat map and acquire new socio-economic information as well. In addition, we will work with NOAA to incorporate information on habitat suitability for groundfish, habitat sensitivity, trawl effort, and other data and models developed through the EFH process.

For our ecoregional-scale conservation planning, TNC has compiled a GIS database of the distribution of important elements of biodiversity in central and northern California. In addition to the Greene benthic habitat dataset (Figure 2), TNC has developed a benthic habitat map based on depth, substrate type and topographic position (flats, ridges, canyons, slopes) and compiled mapped distributions of important biodiversity targets (Figure 3).

We used this database and a site-selection software tool, MARXAN (Ball and Possingham 2000), to identify areas of highest conservation value in the project area. We divided the project area up into equal size (3500 hectare) hexagonal grids. We identified the subset of ecoregional conservation targets present in the project area and set quantitative goals for each target to identify the most important areas for conservation (see Appendix 2 for a list of biodiversity conservation targets present in the project area and used in the analysis). Many of the biodiversity conservation targets are also important for groundfish including:

- representative benthic habitats (using Greene and TNC's benthic model)
- top 20th percentile areas for fish diversity and density (from the NOAA biogeographic assessment, NOAA 2004)
- kelp forests, eelgrass beds, saltmarsh, estuaries
- structure forming invertebrates (deep sea corals, anemones, sponges)
- upwelling zones
- submarine canyons, seamounts, offshore banks
- shelf-slope break (200-300m)
- areas of bathymetric complexity (1 km scale, from NOAA biogeographic assessment, NOAA 2004).

The results of this analysis are presented in Figure 4 as a color gradation map of conservation value. Areas colored in blue are areas of important conservation value (approximately 80% of the project area); dark blue indicates higher conservation value than light blue. Areas colored tan are areas with lower conservation value and represent 20% of the project area.

We used the NOAA Groundfish Habitat Suitability Probability (HSP) database (compiled by TerraLogic GIS, Inc.), which includes HSP values for selected species and life history stages of groundfish for unique polygons defined by habitat, depth, and latitude to evaluate the habitat value of the project area for groundfish. Figure 5 is a color gradation map depicting the number of species / life stages with HSP > 0 in each habitat/depth/latitude polygon in the project area. Figure 6 depicts the summed HSPs for all species / lifestages in each habitat/depth/latitude polygon in the project area. We understand that the HSP database is still undergoing revision and these maps may need to be updated.

The maps of conservation value and EFH value (Figures 4, 5, and 6) and their associated databases would be the primary inputs into a participatory, facilitated process of identifying no-trawl and trawl zones involving TNC, Environmental Defense, trawlers willing to sell, representatives of trawlers and other sectors that would remain, and processors. This participatory process would aim to identify no-trawl zones that would maximize the conservation benefits and EFH protection while accommodating the varied interests of these parties, including: (1) ensuring that sufficiently productive grounds remain open to fishing; (2) minimizing the impacts of changes in fish supply on processors; (3) minimizing adverse impacts on other fishery sectors.

We do not currently have all the information needed to fully analyze this alternative. In particular, the additional data needed to identify no-trawl and trawl zones and analyze conservation and economic impacts include:

- Identification of important sites for conservation that may not have been captured by the regional databases (to be compiled from expert input of regional scientists and fishers). Regional-scale benthic maps do not adequately capture areas of biodiversity importance known from submersible dives and years spent fishing in the region.
- Habitat sensitivity rankings and estimated recovery times for habitats in the project area (from the draft Risk Assessment)
- Identification of areas important for economic sustainability of the fishery (to be compiled from fishers)
- Trawling effort (from confidential trawling logbooks compiled by NMFS)

We request that NOAA Fisheries use the best available fishing effort data from logbooks or other sources and overlay the highest 20% and 30% of fishing effort onto the project area and onto our maps of high conservation and high EFH value areas. Areas of high past fishing effort that do not overlap with areas of high conservation and EFH value can become the presumptive open areas until discussions with stakeholders aimed at identifying optimal open areas are pinpointed and negotiations concluded.

It should be made clear that the maps of conservation value and EFH value presented in this alternative are based on the best science and habitat information available to TNC and Environmental Defense at this time. The trawlers and processors have not yet been involved in development of these initial maps. However, we anticipate initiating a participatory process with the stakeholders in January to exchange information and more precisely identify and agree upon open and closed areas that would be contingent upon a successful buyout process. Once that agreement is reached, TNC, Environmental Defense and the fishers will jointly request the Council to implement these measures.

CONSERVATION IMPACT

Since the no-trawl zones would be sited through a participatory process aimed at minimizing socioeconomic costs and maximizing conservation benefits (and because we do not have access to confidential trawl track information), we cannot provide an accurate appraisal of these costs and benefits at this time.

Designating a significant majority of the project area as no-trawl zones would result in a significant reduction in adverse impacts to habitats important for groundfish and other species. We anticipate a high conservation impact from this alternative, if large areas of high conservation value are protected from trawling impacts, due to the abundance of important biodiversity resources in the project area.

In addition, TNC, if successful in acquiring several "A" endorsement permits, may become the owner of a significant amount of catch history for the west coast groundfish. Further, if the PFMC decides to transition the management of this fishery from trip limits to Individual Fishing Quotas [IFQs], then TNC may end up retaining equity shares in this fishery. Under either or both scenarios, TNC pledges to work closely with the PFMC, NOAA Fisheries and the trawl fleet to explore the disposition possibilities of these fishing privileges. Our current thinking would be to bank approximately 50% of this fish and sell, lease or otherwise transfer approximately 50% to either the residual trawl fleet or non-trawling groundfish fishers.

Economic costs associated with this alternative will be minimized by the nature of the project as many affected fishers and businesses will be financially compensated for any negative financial impacts. It should also be noted that TNC is only negotiating with willing sellers and has no regulatory authority to force any transactions. We will strive to minimize other costs (e.g., to remaining trawlers, other gear sectors, and processors) through equitable siting of remaining trawlable areas.

Advantages

While this alternative was placed in the context of impacts mitigation, it also addresses other core components of the EFH-EIS process:

- Designation and Protection of Essential Fish Habitat: Identification of a large part of the shelf and slope as no-trawl zones would provide protection for EFH for several life stages of multiple species. Identification of these no-trawl areas would be accomplished in conjunction with the Council and would be based on Habitat Suitability models for groundfish and other data compiled during the EIS, fisher knowledge, and other sources of information that TNC has compiled for our ecoregional planning.
- Identification of Habitat Areas of Particular Concern (HAPCs): TNC has compiled data on representative benthic habitats, seamounts, structure-forming invertebrates, canyon heads, estuaries, kelp beds, and many other components of biodiversity and we will work with the Council and fishers to identify HAPCs as core components of the no-trawl zones.
- Minimization of Economic Impacts: TNC/Environmental Defense will use private funds to purchase permits and vessels, and will work with the Council to identify trawlable zones that would promote economic sustainability for the remainder of the fleet and the processors who buy from them.
- Reduced Conflict: The proposed buyout of willing sellers will be contingent upon a set of no-trawl zones, agreed upon through a participatory and deliberative process, potentially reducing conflict over measures to reduce the impacts of trawling in the project area at the Council level.
- Adaptive Management: The identification of trawlable and no-trawl zones in a replicated and scientific manner and the implementation of scientific studies and monitoring will provide much-needed data for adaptive management of the groundfish fishery.

Disadvantages:
Disadvantages of this alternative include:

- Incomplete geographic scope: While the project area contains important fishing grounds, this project would designate only a portion of the PFMC's area of jurisdiction (about 5%) and so does not constitute a full EFH designation and protection alternative. It should be analyzed as a mitigation alternative.

- Paucity of socioeconomic data: We anticipate that this will be rectified through confidential discussions with fishermen aimed at understanding where critically important areas for economic viability are. In addition, we anticipate that NOAA Fisheries will use existing information on trawl intensity to assist with analyzing this alternative.

- Incomplete impact protection: The project focuses on reducing the impacts of bottom trawling exclusively, due to the preponderance of evidence suggesting that bottom trawling damages bottom habitats. It does not afford protection from other kinds of fishing, for which there is less empirical evidence of habitat impacts.

CONSEQUENCES

Effects on Fishery

Ecosystem recovery, increased fish size, increased fish fecundity, and increased larval survivorship due to higher egg viability may result from the establishment of no-trawl zones (provided that these benefits are not dissipated by increased fishing effort by other gear sectors). These effects would be expected to enhance larval export and recruit/spawner ratio. Sport fisheries may benefit from larger fish size and higher encounter rates (due to increased fish population density).

- Displacement of effort: Displacement of fishing effort should be minimal due to purchase of trawlers and careful siting of no-trawl zones. However, there is potential for displacement north of Davenport into the northern section of Monterey Bay National Marine Sanctuary and parts of the Gulf of the Farallones National Marine Sanctuary that also contain areas of very high conservation value (Figure 3).

- Shifts to maximize value: Remaining fishery may shift to fishing to maximize value (e.g., by landing live fish) as a result of reduced tonnage and reduced fishing area.

- Inelastic effort: Trawl effort (e.g., for flatfish) cannot necessarily shift into other gear sectors (e.g., hook/line, pots for rockfish), potentially reducing supply of flatfish to processors.

- Increased costs of federal buyout by remaining trawlers: Existing trawlers are obligated to pay back a share of the federal buyout loan. Because the project would remove some of these trawlers from the fleet, the loan obligation for the remaining trawlers would increase proportionally. Our intent is to include this obligation in our valuation analysis.

- Fate of fish "released" through buyout unclear: If all of the fish that was caught by the bought-out trawlers were re-allocated to remaining trawlers, this might compensate for reduced trawlable area; however, it may not be possible for the trawlers remaining in the project area to catch all of this allocation due to the reduced area available for trawling. In addition, if the re-allocated fish were caught somewhere else, this would reduce supply to local processors.

Effects on Other Fisheries

There may be potential increase in revenues for other gear sectors targeting the same fish (e.g., fixed gear sablefish, thornyhead, rockfish).

There may be reduced gear conflict (potentially increasing area available for other gear sectors within the project area).

Effects on Protected Species

There are numerous protected species of fish, seabirds, sea turtles and marine mammals that occur in the project area. There are no anticipated adverse impacts to protected species from this alternative.

Potential benefits to protected species include: reductions in incidental bycatch or injury of protected species in trawl nets and increases in prey species abundances with habitat recovery and recovery of groundfish populations.

Effects on Non-Fishing Activities

Harbors and ports receive federal dredging funds in proportion to the tonnage of fish landed. Buying out a significant number of trawlers may reduce landings and dredging funds unless legislative changes are made.

Increased species diversity, abundance, and ecosystem recovery could enhance nearshore ecotourism.

Existence value, option value, heritage value of no-trawl zones would be enhanced.

Effects on Law Enforcement and Compliance

Conceptually, large no trawl zones should present no significant new law enforcement or compliance challenges. They could be enforced in the same way as other closed areas. Compliance should increase as Vessel Monitoring Systems are introduced and finalized into the fleet as planned. Enforcement capacity has been enhanced in other National Marine Sanctuaries through the cross-deputization of agents from several enforcement bodies at the state, regional and federal levels.

SUMMARY

TNC/Environmental Defense proposes to work with the bottom trawling industry and the Council to develop a private buy-out program that is contingent on the establishment of permanent no-trawl zones covering a large portion of the area between Point Conception and Davenport   (including portions of the Monterey Bay National Marine Sanctuary) and nearby seamounts to protect EFH and other important biodiversity targets in the project area of Central California.

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RELEVANT LITERATURE

Auster P. 1998. A conceptual model of the impacts of fishing gear on the integrity of fish habitats. Conservation Biology 12(6): 1198-1203.

Ball, I. and H. Possingham. 2000. MARXAN (v.1.8.0): Marine reserve design using spatially explicit annealing. A manual prepared for the Great Barrier Reef Marine Park Authority. March.

Bergman, M.J.N. and M. Hup. 1992. Direct effects of beamtrawling on macrofauna in a sandy sediment in the southern North Sea. ICES, Journal of Marine Science. 49: 5-11.

Dayton P.K., S. Thrush and F.C. Coleman. 2002. Ecological Effects of Fishing in Marine Ecosystems of the United States. Pew Oceans Commission, Arlington, Virginia.

Engel J and R Kvitek. 1998. Effects of otter trawling on a benthic community in Monterey Bay National Marine Sanctuary. Conservation Biology 12 (6): 1204-1214.

Federal Register. Fisheries off the West Coast States and the Western Pacific; Pacific Coast Groundfish Fishery; Intent to prepare an environmental impact statement for fishing conducted under the Pacific Coast groundfish fishery management plan. 68(108): 33670-1.

Frid C. 2003. Managing the health of the seafloor. Front. Ecol. Environ. 1(7): 429-436.

Friedlander, A. M., G. W. Boehlert, M. E. Field, J. E. Mason, J. V. Gardner, and P. Dartnell. 1999. Sidescan-sonar mapping of benthic trawl marks on the shelf and slope off Eureka, California. Fishery Bulletin 97: 786-801.

Gillelan H. 2002-2003. Homeless fish: bottom trawls bulldoze seafloor habitat. Wild Earth (winter): 34-38.

Johnson, K. 2002. A Review of National and International Literature on the Effect of Fishing on Benthic Habitats. NOAA Technical memorandum NMFS-F/SPO-57. 72 p.

Kaiser M. 2003. Detecting the effects of fishing on seabed community diversity: importance of scale and sample size. Conservation Biology 17(2): 512-520.

Kaiser M. 1998. Significance of bottom-fishing disturbance. Conservation Biology 12(6): 1230-1235.

Kaiser M, F Spence, and P Hart. 2000. Fishing-gear restrictions and conservation of benthic habitat complexity. Conservation Biology 15(5): 1512-1525.

Matthews, K.R. and L.J. Richards. 1991. Rockfish (Scorpaenidae) assemblages of trawlable and untrawlable habitats off Vancouver Island, British Columbia. N. Am. J. Fish. Manag. 11: 312-318.

National Oceanic and Atmospheric Adminstration (NOAA), 2004. A Biogeographic Assessment Off North/Central California: To Support the Joint Management Plan Review for Cordell Bank, Gulf of Farallones, and Monterey Bay National Marine Sanctuaries: Phase I – Marine Fishes, Birds, and Mammals.

National Research Council (NRC). 2002. Effects of Trawling & Dredging on Seafloor Habitat. DC: National Academy Press. 125 p.

Thrush S and P Dayton. 2002. Disturbance to marine benthic habitats by trawling and dredging: implications for marine biodiversity. Annu. Rev. Ecol. Syst. 33: 449-73.

Watling L and E Norse. 1998. Disturbance of the seabed by mobile fishing gear: a comparison to forest clearcutting. Conservation Biology 12(6): 1180-1197.


Figure 1. Central California Project Area
San Francisco
Gumdrop & Pioneer Seamounts
San Jose
Point Ano Nuevo
Santa Cruz
Guide Seamount
Canyon
Monterey
Monterey
-3000m
Davidson Seamount
Morro Bay
Santa Maria
-3000m
Point Conception
Rodriguez Seamount
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Figure 2. Benthic Habitats

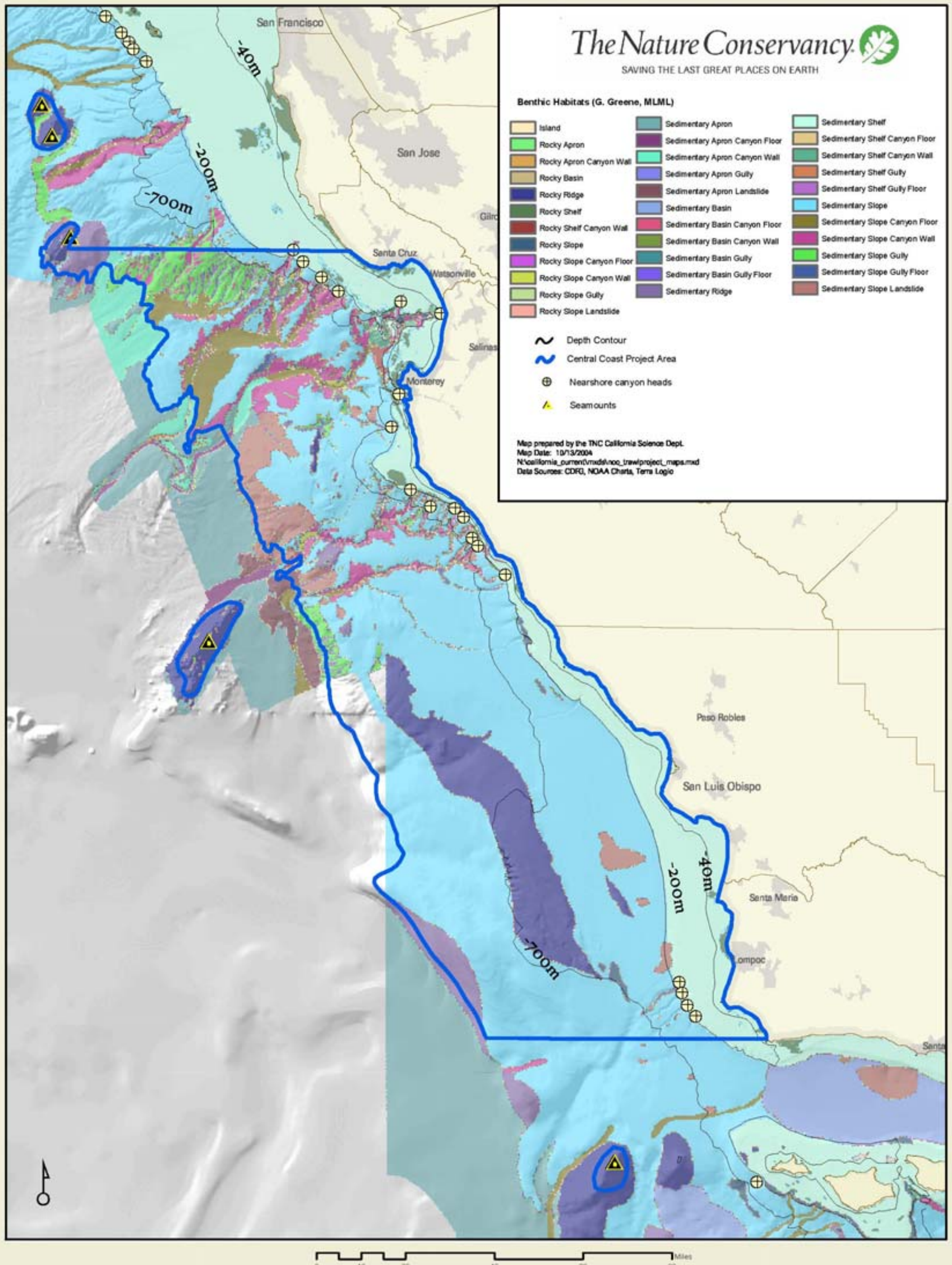


Figure 3. Other Conservation Targets

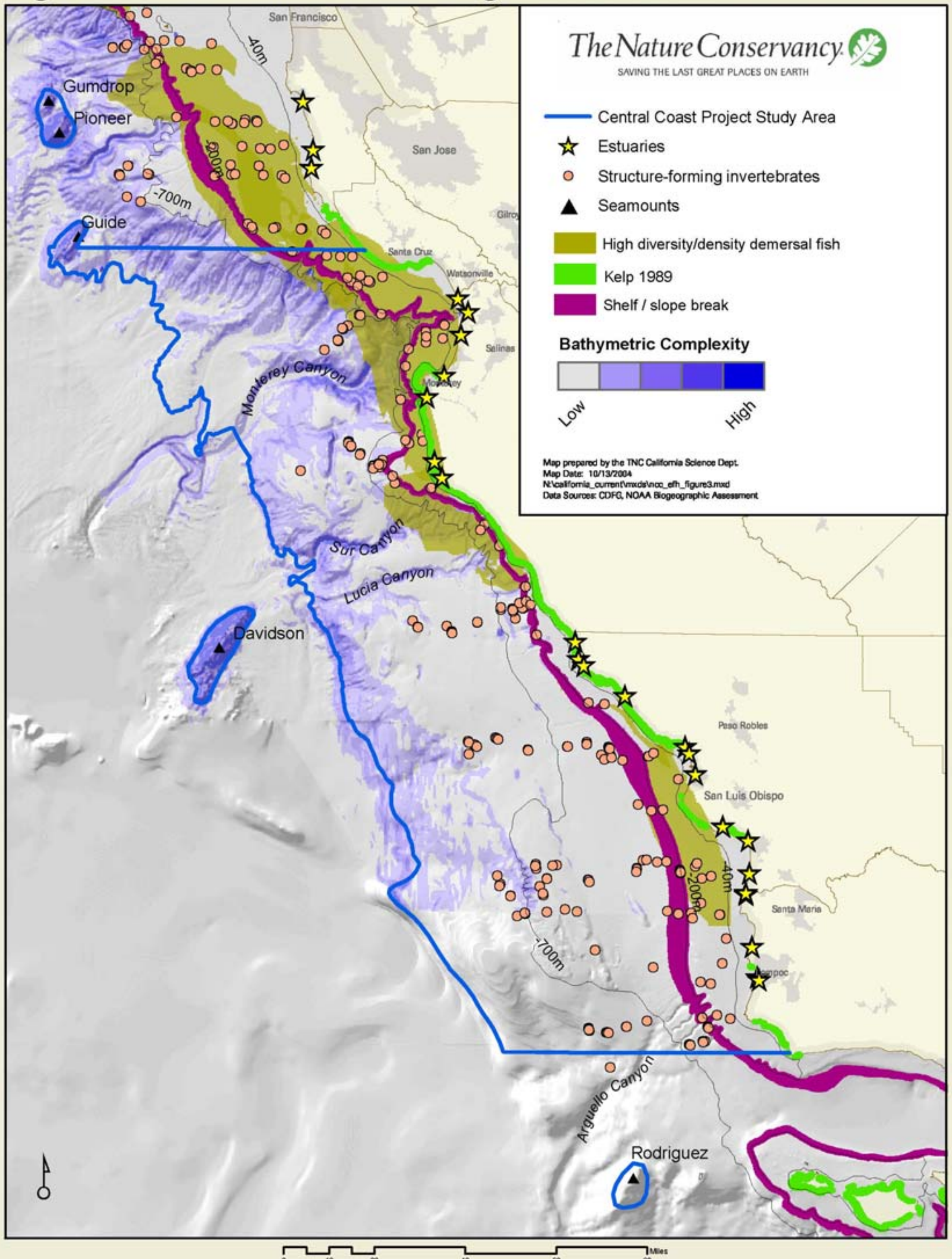


Figure 4. Conservation Value

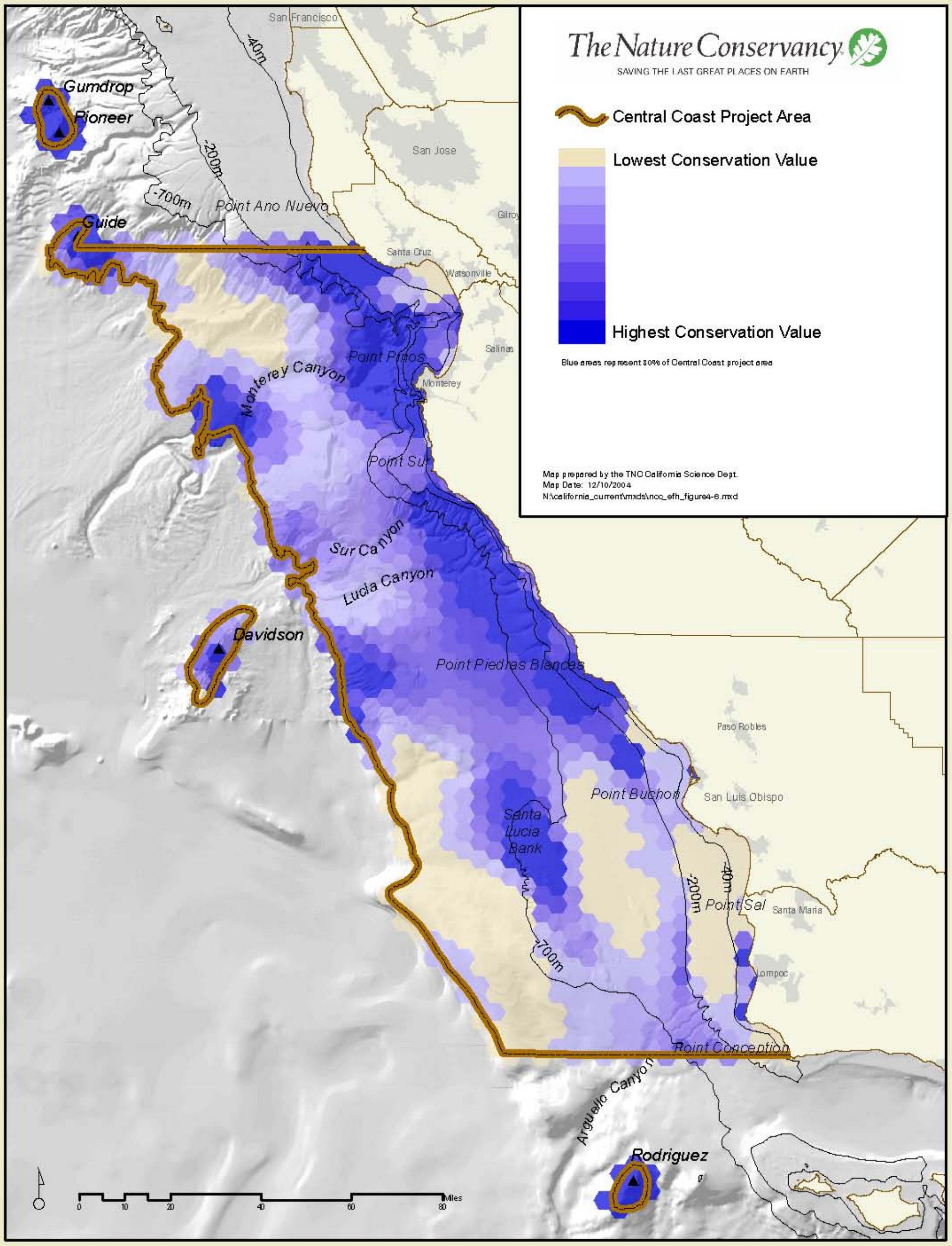
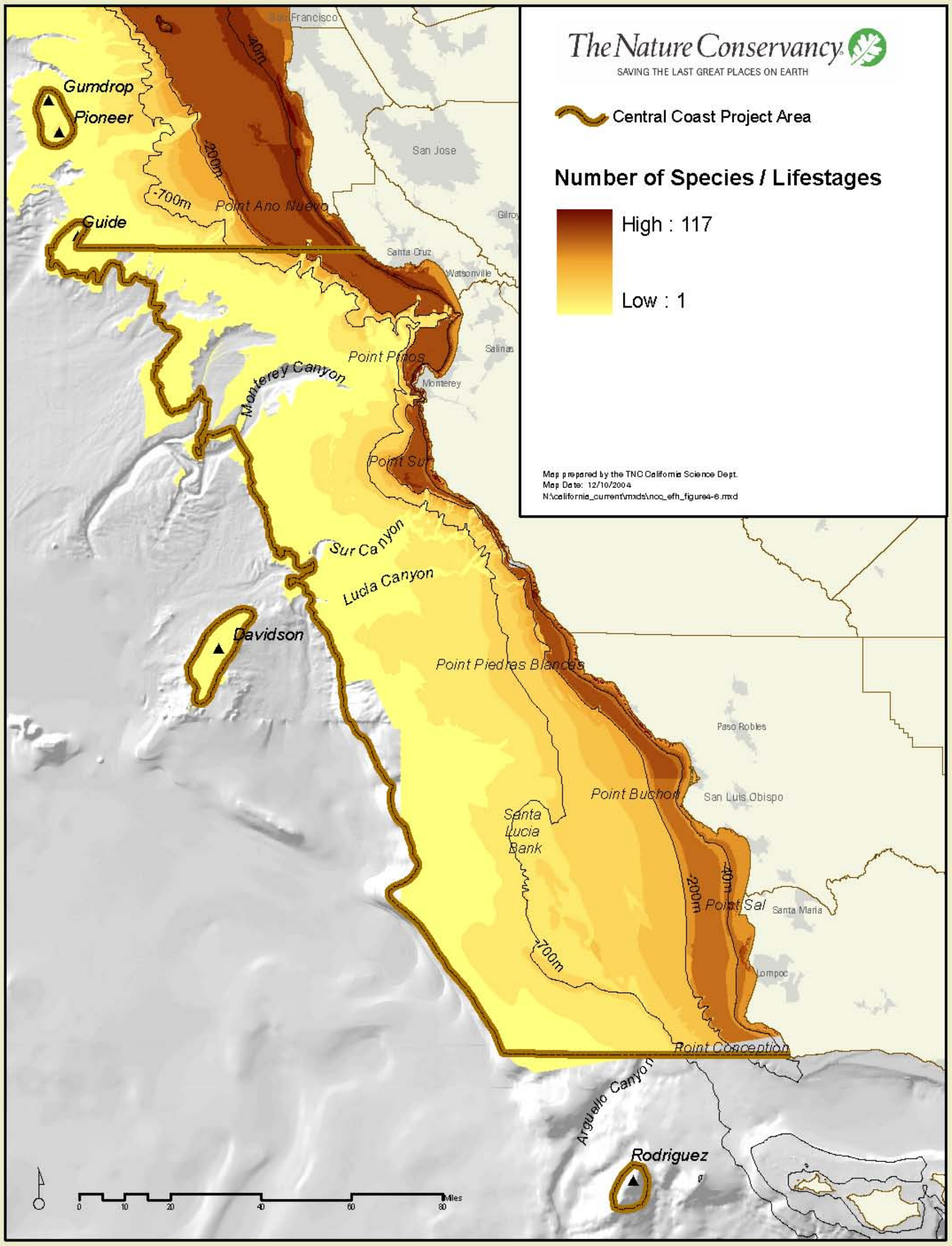


Figure 5. EFH Value - Number of Species / Lifestages



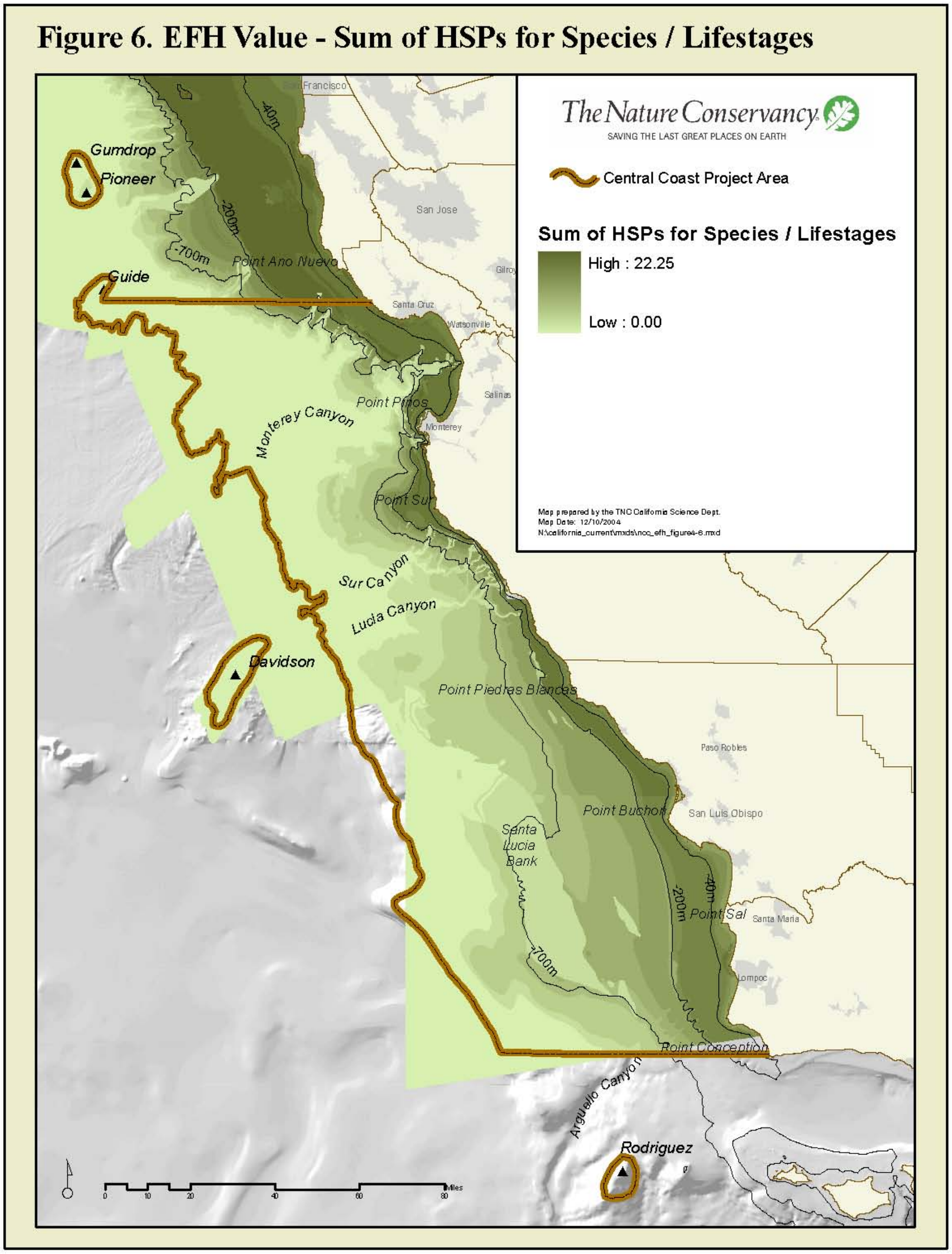


Figure 6. EFH Value - Sum of HSPs for Species / Lifestages
The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH
Central Coast Project Area
Sum of HSPs for Species / Lifestages
High : 22.25
Low : 0.00
Gumdrop
Pioneer
Guide
Point Ano Nuevo
Monterey Canyon
Point Pinos
Point Sur
Sur Canyon
Lucia Canyon
Davidson
Point Piedras Blancas
Point Buchon
Santa Lucia Bank
Point Sal
Point Conception
Arguello Canyon
Rodriguez
San Jose
Santa Cruz
Watsonville
Salinas
Monterey
Paso Robles
San Luis Obispo
Santa Maria
Lompoc
40m
200m
700m

APPENDIX 1: IMPACTS OF BOTTOM TRAWLING

Few studies of the impacts of trawling have been conducted in the project area; however, the scientific consensus (including the expert opinion of scientists serving on the Pacific Fishery Management Council's technical advisory committee on Essential Fish Habitat, which is charged in part with assessing the impacts of fishing in federal waters off the US Pacific coast) is that inferences about the impacts of trawling in a particular place can be made from the dozens of studies of trawl impacts conducted throughout the world, with appropriate adjustments made for differences in habitat type, biota, and fishing practices. Studies off the US Pacific coast have documented many of the impacts of bottom trawling, including substantial losses of biodiversity, reduction of habitat complexity, and changes in species composition. Video cameras attached to trawls operating off the US Pacific coast show, anecdotally, resuspension of sediment and the removal of biogenic structure.

Direct Impacts of Bottom Trawling

While the project area comprises only about 5% of the PFMC's jurisdiction, it supports important commercial fisheries, particularly for sardines, squid, roundfish, flatfish and rockfish. These species occupy a diverse range of habitats including soft sediment, rocky bottom varying in relief from low to high, seamounts, and submarine canyons to depths reaching 3,000 ft. The project is focused on buying bottom trawlers because the best available science strongly indicates that bottom trawling can damage certain kinds of habitats, particularly biogenic habitat such as corals and sponges. The draft risk analysis for the Pacific Coast included an evaluation of the sensitivity of different habitat types to fishing impacts from 5 major gear types, including bottom trawling, and ranked portions of the project area, especially the slope, with the highest sensitivity ranking (2.26-3.0) and longest recovery times (Risk Assessment for the Pacific Groundfish FMP, v. 4. August 2004). In addition, available evidence demonstrates that bottom trawling has significant ecological impacts in unconsolidated soft sediments, due to the removal of small-scale biogenic and physical structure, resuspension of sediments, and exposure of species living in the sediments to higher predation rates.

Bottom-trawling has become a source of concern because of the size of the affected fishing grounds, the modification of the substrate, disturbance of benthic communities and removal of non-target species (NRC 2002). One study suggests that a typical trawl fishery in northern California trawls the seafloor about 1.5 times per year, with some areas being trawled as much as 3 times per year. Considering the slow recovery times of these benthic communities, this level of disturbance is sufficient to result in a vastly altered community (Friedlander et al., 1999).

The repeated use of bottom-tending gear such as trawls can cause long-term biological and physical changes in the marine environment (depending on substrate type, abundance of habitat-forming invertebrates like corals and sponges, and other factors) that can be orders of magnitude greater in intensity and spatial extent than natural disturbances (Watling & Norse 1998).

<u>Alteration of Physical Structure.</u> Trawl gear can scrape, plough, bury mounds, smooth sand ripples, remove stones or drag boulders, remove species that produce structure, and remove or shred submerged aquatic vegetation (Johnson 2002, Kasier et al. 2000). The structural complexity of rocky outcrops, critical for biodiversity, can be reduced substantially by trawling. These physical alterations reduce the heterogeneity of the sediment surface, alter the texture of the sediments and reduce the structure available to biota as habitat (Johnson 2002), resulting in a concomitant decrease in the quality of habitat for some species (NRC 2002). Rocks and mounds contribute to the structural complexity of the bottom, and are very important to many different kinds of organisms that are found only in association with such structures. Exposed sediments tend to be poorer in food quality than sediments that are covered with encrusting organisms or held together by tube-forming organisms; hence, productivity is usually lower. Debris (usually fragments of kelps, marine "snow", fecal material, and the like) is a critically important food source for many benthic organisms. Not surprisingly, a study in the Monterey Bay National Marine Sanctuary (MBNMS) showed that sea pens, sea stars, sea anemones, sea slugs, and most polychaete worms were all far less abundant in the highly trawled area. Nematode and oligochaete worms (opportunistic species) were more abundant in the highly trawled area, but overall, trawling clearly reduced overall biodiversity (Engel and Kvitek, 1998).

Trawling also alters the structure of soft sediments. In shallower depths, organic-silty sand may become sandy gravel littered with shell fragments (Dayton et.al., 1995; see also Langton & Robinson, 1990). Deep shelf trawling induces sediment changes by transporting fine sediments to regions where currents do not naturally carry them (Churchill, 1989; Churchill et.al., 1994). By increasing turbidity in benthic habitats (via anthropogenically-transported sediments and the re-suspension of naturally-occurring sediments), trawls indirectly smother suspension feeders, kill larvae, and eliminate deep-water corals (Jones, 1992). After intense trawling disturbances, suspension-feeding groups generally become replaced by detritus feeding populations. Rarely do these community structural changes revert back to their initial suspension-feeding dominance because suspension-feeding recruits are frequently smothered or consumed by detritus feeders.

<u>Changes to the Benthic Community</u>. Trawling results in acute effects on resident populations, the range of which depends on the life history, ecology, and physical characteristics of the biota present. In general, species that are larger, less mobile, longer-lived, and experience low rates of natural disturbance appear to sustain longer term damage from bottom trawling. The following trends are observed in repeated or intensively fished areas:

<u>Reduced Biomass</u>: Trawling is capable of removing large amounts of biomass. When the species affected are long-lived and slow-growing, recovery can be slow. Off southern Tasmania, for example, fished seamounts had 83% less biomass than similar lightly fished sites (Dayton et al. 2002).

Reduced Species Diversity: Large, non-mobile, slow growing bottom-dwelling species recover less quickly than species that exhibit high fecundity and rapid generation times or that can adapt to frequent physical disturbance. There is evidence that trawling reduces the abundance and diversity of bottom-dwelling species such as anemones, sponges, and snow crab. In the Monterey Bay National Marine Sanctuary, heavily trawled areas exhibited about half the species diversity of lightly trawled areas (Engel and Kvitek, 1998). Another Pacific study found significant differences in demersal rockfish assemblages between trawled and untrawled areas (Matthews & Richards, 1991). The rockfish assemblages differed significantly in species composition, biodiversity, and biomass, with the untrawlable regions having significantly larger catches than the trawlable habitats (Matthews & Richards, 1991). This finding indicates that as more regions become trawlable and benthic habitats are altered, there may well be significant changes in species composition and biomass.

Shift in community dominance: Some areas historically dominated by low-productivity, long-lived species are now dominated by high-productivity, short-lived, fast growing species (Kaiser et al. 2000). These species are able to capitalize on the changes in habitat resulting from trawling. For example, heavily trawled areas support low biomass levels of hydroids, soft coral and urchin and high levels of brittlestar, scavenging hermit crab, and masked crab. After trawling exposure, numerous benthic species die, with the greatest injury inflicted upon sessile organisms, including (but not limited to) polychaetes, bryozoans, echinoderms, and mollusks (Jones, 1992; Northridge, 1991; Bullimore, 1985; and Holme, 1983). Trawls remove organisms at the top of the substrate and expose animals which normally live buried in the sediments. These community alterations make many benthic organisms more susceptible to predation. In effect, trawling alters trophic dynamics by creating new food sources for opportunistic species such as scavenger starfish and crabs (Thrush, et.al., 1995; Dayton et.al., 1995). In addition to showing that high levels of trawling reduce overall marine biodiversity, Engel and Kvitek (1998) showed that heavy trawling can increase the abundance of certain kinds of organisms. In this case, the polychaete worm *Chloeia pinnata* achieved very high densities in the heavily trawled area. Many commercially important flatfish feed on this worm as adults, such as sanddab, English sole, and Dover sole. While trawling could thus increase food for adult fish, it could simultaneously decrease food and shelter for more sensitive life stages. This conclusion is supported by other research cited in the study.

Changes in species distribution: Intensively fished areas are likely to remain permanently altered, inhabited by fauna that can cope with frequent physical disturbance (NRC 2002). In the MBNMS, heavily trawled areas support opportunistic species such as oligochaete worms (pioneer species known to be early colonizers in frequently disturbed areas and scavengers that feed on dead organic matter) and nematodes (one of the most abundant animals on earth, often found in extremely harsh environments) (Engel & Kvitek 1998).

Indirect Effects of Bottom Trawling

Trawling directly impacts species diversity and habitat structure and function; but it also has several important indirect effects on marine ecosystem dynamics (NRC 2002).

Sediment Suspension: the drag of the gear along the seafloor can suspend large amounts of sediment in the water, resulting in the reduction of light available for photosynthetic organisms, burial of benthic biota, smothering of spawning areas, and effects on feeding and metabolic rates of species (Johnson 2002).

Nutrient Cycling: trawling can increase or decrease the exchange rate of nutrients between the sediment and water column and the suspension or burial of biologically recyclable organic material, thus changing the flow of nutrients through the food web (NRC 2002).

Ecosystem Processes: trawling can remove species responsible for water purification, substrate stabilization, and structure formation, thus altering these important ecological processes/services (NRC 2002).

The potential of trawl fishing to damage marine habitats has greatly increased (and continues to increase) with technological advances, absent performance standards. For example, beam trawlers (an older, less damaging type of technology than otter trawls) with tickler chains caught 10 times the amount of seabed material in their trawls as did the beam trawls without tickler chains; the amount of debris caught in trawls positively correlates with the number of benthic organisms adversely affected. As engines have become more powerful, synthetic materials have grown stronger, and new gears (e.g. bobbins, rollers, rock hopper sweeps, chains) are developed fishermen gain access to previously un-trawlable, rocky bottoms (Dayton et.al., 1995; Matthews & Richards, 1991).

Because all trawling is not destructive, we favor the implementation of performance standards for gear impacts on habitats would be developed that would apply to all gear types, so as to create incentives for innovative gear designs and practices that will minimize impacts everywhere. Such standards would complement Essential Fishing Habitat (EFH) regulations very well. In addition, we anticipate that over the long-term, other gear sectors will be rationalized in some way, whether through stackable permits, cooperatives, Individual Fishing Quotas (IFQs), or other mechanisms. In this way, capacity issues associated with spatial management in the form of marine reserves, EFH, or Habitat Areas of Particular Concern (HAPC) designations and regulations can be addressed.

APPENDIX 2: CONSERVATION TARGETS PRESENT IN PROJECT AREA AND GOALS USED TO IDENTIFY HIGH CONSERVATION VALUE AREAS
December 10, 2004

Target Type	Conservation Target	Data Source	Goal (%)	Units
Shoreline Types	Exposed wave cut rocky platform	NOAA-ESI	30	kilometers
	Exposed wave cut rocky platform/ beach	NOAA-ESI	30	kilometers
	Exposed rocky cliff	NOAA-ESI	30	kilometers
	Sheltered rocky shore	NOAA-ESI	30	kilometers
	Gravel Beach	NOAA-ESI	30	kilometers
	Coarse grained sand beach	NOAA-ESI	30	kilometers
	Mixed sand and gravel beach	NOAA-ESI	30	kilometers
	Fine to medium grained sand beach	NOAA-ESI	30	kilometers
	Exposed tidal flat	NOAA-ESI	30	kilometers
	Sheltered tidal flat	NOAA-ESI	30	kilometers
	Tidal flat / salt marsh	NOAA-ESI	30	kilometers
	Sand spits	USGS topos	30	Presence/ absence
Ecosystems / Communities	Coastal Dunes	USGS, NPS, Calveg	30	hectares
	Kelp -1989	CDFG (1989)	50	hectares
	Kelp -1999	CDFG (1999)	50	hectares
	Kelp -2002	CDFG (2002)	50	hectares
	Kelp -2003	CDFG (2003)	50	hectares
	Persistent kelp beds (present 3 out of 4 years)	CDFG ('89, '99, '02, '03)	50	hectares
	Coastal salt marsh	ESI/ CDF / NDDB	75	Kilometers / hectares
	Medium Estuaries / Lagoons (1,000 – 7,500 acres)	NWI / ESI	50	hectares
	Small Estuaries / Lagoons (2 to 1,000 acres)	NWI / ESI	50	hectares

	Eelgrass	ESI / Morro Bay Estuary Program	50	hectares
Biologically Significant Areas	Upwelling zone	NOAA Coastwatch AVHRR (March-Sept, years 2000-2003)	50	presence/ absence
	Seamounts	Baja to Bering CD	100	presence / absence
	Off-shore rocks and islets	BLM	30	presence / absence
	Off-shore banks	DEM from CDFG; NOAA nautical chart	50	Hectares
	Near-shore canyon head	DEM from CDFG; NOAA nautical chart	50	presence / absence
	Major submarine canyons	DEM from CDFG; NOAA nautical chart	50	Presence / absence
	Shelf-slope break (200m-300m contour)	DEM from CDFG	50	presence / absence
	High bathymetric complexity (areas w/ >2 std.dev complexity)	DEM from CDFG; NOAA Biogeographic assessment	50	hectares
SPECIES Inverts:	Structure Forming Invertebrates (corals, anemones, sponges)	NMFS Data from EFH EIS	50	presence / absence
Fish:	Steelhead stream outlet [Central CA ESU and Northern CA ESU]	NOAA / CDFG / Jigour (Titus dataset)	50	presence / absence
	Coho stream outlet [Central CA ESU and SoOr/NoCA ESU]	NOAA / CDFG	50	presence / absence
	Tidewater goby	NDDB / ESI	50	presence / absence
	Fish Top 20th Diversity	NOAA Biogeogr.	50	Hectares
	Fish Top 20th Density	NOAA Biogeogr.	50	Hectares
Birds:	Bird Top 20th Diversity	NOAA Biogeogr.	50	Hectares
	Bird Top 20th Density	NOAA Biogeogr.	50	Hectares
	Seabird colony: Caspian tern	Sowls et al 1980; Carter et al 1992	50	individuals

	Seabird colony: Forester's tern	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Double-crested cormorant	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Brants cormorant	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Pelagic cormorant	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Common murre	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Pigeon guillemot	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Tufted puffin	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Rhinosaurus auklet	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: Black oystercatcher	Sowls et al 1980; Carter et al 1992	50	individuals
	Seabird colony: CA Least tern	NDDB; SFBBO (C. Strong)	50	individuals
	Western snowy plover	NDDB; PRBO (G.Page); SFBBO (C. Strong)	50	presence / absence
	Clapper rail	NDDB; ESI	50	presence / absence
	California Black rail	NDDB; ESI	50	presence / absence
	Stellar sea lion rookery	NOAA - Mark Lowry	50	Individuals
	Northern elephant seal rookery	NOAA – Mark Lowry	50	Presence / absence
	Harbor seal haulouts	NOAA- Mark Lowry	30	individuals
	Stellar sea lion haulouts	NOAA- Mark Lowry	30	Presence / absence
	California sea lion haulouts	NOAA- Mark Lowry	30	presence / absence
	Sea otter – (high, medium, and low density segments)	USGS-BRD / CDFG / MB Aq. – Spring 2001 surveys	30	presence / absence

Benthic Habitat Types (modeled)	INNER SHELF (0-40m) CANYON_SOFT	Benthic Habitat Model	30	Hectares
	INNER SHELF (0-40m) SLOPE_HARD	Benthic Habitat Model	50	Hectares
	INNER SHELF (0-40m) SLOPE_SOFT	Benthic Habitat Model	30	Hectares
	INNER SHELF (0-40m) FLATS_HARD	Benthic Habitat Model	50	Hectares
	INNER SHELF (0-40m) FLATS_SOFT	Benthic Habitat Model	30	Hectares
	INNER SHELF (0-40m) RIDGE_HARD	Benthic Habitat Model	50	Hectares
	INNER SHELF (0-40m) RIDGE_SOFT	Benthic Habitat Model	30	Hectares
	MID-SHELF (40-200m) CANYON_HARD	Benthic Habitat Model	50	Hectares
	MID-SHELF (40-200m) CANYON_SOFT	Benthic Habitat Model	30	Hectares
	MID-SHELF (40-200m) SLOPE_HARD	Benthic Habitat Model	50	Hectares
	MID-SHELF (40-200m) SLOPE_SOFT	Benthic Habitat Model	30	Hectares
	MID-SHELF (40-200m) FLATS_UNCLASSIFIED	Benthic Habitat Model	30	Hectares
	MID-SHELF (40-200m) FLATS_HARD	Benthic Habitat Model	50	Hectares
	MID-SHELF (40-200m) FLATS_SOFT	Benthic Habitat Model	30	Hectares
	MID-SHELF (40-200m) RIDGE_UNCLASSIFIED	Benthic Habitat Model	30	Hectares
	MID-SHELF (40-200m) RIDGE_HARD	Benthic Habitat Model	50	Hectares
	MID-SHELF (40-200m) RIDGE_SOFT	Benthic Habitat Model	30	Hectares
	MESOBENTHAL (200-700m) CANYON_HARD	Benthic Habitat Model	50	Hectares

	MESOBENTHAL (200-700m) CANYON_SOFT	Benthic Habitat Model	30	Hectares
	MESOBENTHAL (200-700m) SLOPE_HARD	Benthic Habitat Model	50	Hectares
	MESOBENTHAL (200-700m) SLOPE_SOFT	Benthic Habitat Model	30	Hectares
	MESOBENTHAL (200-700m) FLATS_UNCLASSIFIED	Benthic Habitat Model	30	Hectares
	MESOBENTHAL (200-700m) FLATS_HARD	Benthic Habitat Model	50	Hectares
	MESOBENTHAL (200-700m) FLATS_SOFT	Benthic Habitat Model	30	Hectares
	MESOBENTHAL (200-700m) RIDGE_HARD	Benthic Habitat Model	50	Hectares
	MESOBENTHAL (200-700m) RIDGE_SOFT	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) CANYON_UNCLASSIFIED	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) CANYON_HARD	Benthic Habitat Model	50	Hectares
	BATHYBENTHAL (700-5000m) CANYON_SOFT	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) SLOPE_UNCLASSIFIED	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) SLOPE_HARD	Benthic Habitat Model	50	Hectares
	BATHYBENTHAL (700-5000m) SLOPE_SOFT	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) FLATS_UNCLASSIFIED	Benthic Habitat Model	30	Hectares

	BATHYBENTHAL (700-5000m) FLATS_HARD	Benthic Habitat Model	50	Hectares
	BATHYBENTHAL (700-5000m) FLATS_SOFT	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) RIDGE_UNCLASSIFIED	Benthic Habitat Model	30	Hectares
	BATHYBENTHAL (700-5000m) RIDGE_HARD	Benthic Habitat Model	50	Hectares
	BATHYBENTHAL (700-5000m) RIDGE_SOFT	Benthic Habitat Model	30	Hectares
Benthic Habitats (G. Greene)	Sedimentary Slope	Greene	30	Hectares
	Sedimentary Shelf	Greene	30	Hectares
	Sedimentary Ridge	Greene	30	Hectares
	Rocky Ridge	Greene	50	Hectares
	Sedimentary Apron	Greene	30	Hectares
	Sedimentary Slope Gully	Greene	30	Hectares
	Sedimentary Slope Canyon Floor	Greene	30	Hectares
	Sedimentary Basin	Greene	30	Hectares
	Sedimentary Slope Canyon Wall	Greene	30	Hectares
	Sedimentary Slope Landslide	Greene	30	Hectares
	Rocky Shelf	Greene	50	Hectares
	Rocky Slope	Greene	50	Hectares
	Sedimentary Apron Canyon Wall	Greene	30	Hectares
	Sedimentary Slope Gully Floor	Greene	30	Hectares
	Island	Greene	30	Hectares
	Sedimentary Apron Canyon Floor	Greene	30	Hectares
	Sedimentary Apron Landslide	Greene	30	Hectares
	Rocky Slope Canyon Wall	Greene	50	Hectares

	Sedimentary Shelf Canyon Wall	Greene	30	Hectares
	no data	Greene	30	Hectares
	Rocky Shelf Canyon Wall	Greene	50	Hectares
	Rocky Slope Gully	Greene	50	Hectares
	Rocky Slope Landslide	Greene	50	Hectares
	Sedimentary Shelf Canyon Floor	Greene	30	Hectares
	Sedimentary Apron Gully	Greene	30	Hectares
	Rocky Apron	Greene	50	Hectares
	Rocky Apron Canyon Wall	Greene	50	Hectares